



A.D. 1864, 23rd JANUARY. N° 195.

SPECIFICATION

OF

ROBERT ALFRED WRIGHT  
AND  
ERNEST WRIGHT.

CONSUMING SMOKE IN FURNACES.

LONDON:

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,

PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

PUBLISHED AT THE GREAT SEAL PATENT OFFICE,

25, SOUTHAMPTON BUILDINGS, HOLBORN.

1864.







---

A.D. 1864, 23rd JANUARY. N° 195.

---

**Consuming Smoke in Furnaces.**

---

**LETTERS PATENT** to Robert Alfred Wright, of Pentonville Road, in the County of Middlesex, Engineer, and Ernest Wright, of Nelson Square, Blackfriars Road, in the County of Surrey, India-rubber Merchant, for the Invention of “**IMPROVEMENTS IN APPARATUS FOR CONSUMING SMOKE AND PROMOTING THE COMBUSTION OF FUEL IN FURNACES.**”

Sealed the 15th July 1864, and dated the 23rd January 1864.

---

**PROVISIONAL SPECIFICATION** left by the said Robert Alfred Wright and Ernest Wright at the Office of the Commissioners of Patents, with their Petition, on the 23rd January 1864.

We, **ROBERT ALFRED WRIGHT**, of Pentonville Road, in the County of Middlesex, Engineer, and **ERNEST WRIGHT**, of Nelson Square, Blackfriars Road, in the County of Surrey, India-rubber Merchant, do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN APPARATUS FOR CONSUMING SMOKE AND PROMOTING THE COMBUSTION OF FUEL IN FURNACES,**” to be as follows:—

10 The object of our Invention is to effect combustion of smoke in furnaces. For this purpose we employ gases produced by the decomposition of steam or water, which gases we project into the furnace through nozzles, burners, nipples, or orifices, so arranged that the gaseous jets or streams projected therefrom shall impinge against and cross each other, and be thereby caused  
15 to spread and to veil the surface of the fire. We also project air into the



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

furnace as well as or instead of the above gases. The nozzles or burners may be disposed at an angle, or each nozzle or burner may have two or more perforations therein, so that the jets may cross each other.

To avoid repetition we call the pipes, tubes, retorts, or vessels in which the steam or water is decomposed the decomposing apparatus. These pipes or 5 vessels may be filled with fragments of iron, zinc, pottery, or other substance to facilitate decomposition. The air may be admitted through passages surrounding or opposite the pipes, nozzles, or orifices through which the gases are led or projected into the furnace. The air holes may be opened and closed to the required extent by a perforated slide or plate, having also slots in it through 10 which the pipes, nozzles, or burners which project the gases are carried, so that the slide may be worked to and fro. The feed pipe of the decomposing apparatus is furnished with a safty valve to prevent explosion. The plates at the back of our furnace may be cased or lined with refractory material. We construct an improved decomposing apparatus of one or more hollow discs 15 having one plane and one convex surface. Also for decomposing the steam or water and for projecting the gases, D shaped pipes or pipes having one plane and one convex surface may be used, the flat surface being against the boiler plates.

We sometimes use decomposing or gas projecting pipes of a  $\Delta$  shape 20 fitting into the angles of the fire-box or pipes, having one convex and two plane surfaces or sides. We sometimes form in the bridge passages or apertures through which the gases produced in the decomposing apparatus or air under pressure are projected through a tube having nozzles, perforations, or burners, and placed in the body of the bridge. The passages, which may 25 be lined with iron, wholly or partially communicate with the ash-pit and admit air therefrom, and have a regulating register or damper, the admission of gases to the nozzles or burners being regulated from the front of the furnace; the air thus becomes heated and propelled by the jets of steam, gas, or air with force and rapidity, so that it mingles with the gases of the fuel in combustion. 30 I sometimes propel the air through the bridge by admitting steam from the boiler without passing it through the decomposing apparatus, the heat of the bridge or the lining of the passages assisting to decompose the steam, the gases or steam or air being highly heated in their passage through the bridge are projected in an upward inclined direction towards the arch or lining and 35 in the direction of the draft, and mix with the gases of the fuel in combustion, the decomposition of which they promote.

We sometimes insert in the arch or lining the tube having nozzles or burners projecting downwards and in the direction of the draft. We some-



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

times place in the furnace over the fire a pipe of **D** or other shape, having its plane side next to the boiler plate and with nozzles or burners projecting downward towards the bridge in the direction of the draft.

The decomposing apparatus may be in the arch, or it may be a separate  
5 apparatus whence the products are conveyed into the furnace. Vertical,  
horizontal, or inclined pipes may be used for decomposing. We introduce  
the air under pressure, and sometimes heat it by passing it through a coil  
or through the decomposing apparatus. We usually project the gases pro-  
duced by decomposition together with air into the furnace, but we sometimes  
10 project heated air therein without the gases, employing for the projection of  
the air nozzles, burners, or orifices and pipes arranged as described for the  
projection of gases.

In Cornish boilers, according to one arrangement, the decomposing apparatus  
is placed in the bridge, over which a refractory arch is fitted. The gaseous  
15 products of decomposition are led from the decomposing apparatus to the  
front and outside of the furnace, and are conveyed into it again above the door  
to be projected as described. Air may be admitted through or over the door,  
or through the door frame or the dead plate, and forced into intimate com-  
bination with the products of combustion by inclining the gas nipples, burners,  
20 or orifices downward.

In locomotives, in one arrangement, we fit a bridge in the fire-box below the  
tubes and place the decomposing apparatus in this bridge, whence the gases  
are led under the fire bars to outside the furnace, and are thence brought into  
it through the hollow stays in the water space below the furnace door, so that  
25 the gases may be projected into the furnace below the door. Over the bridge  
is an arch whereby the gases are agitated and the products of combustion  
baffled.

For marine boilers the decomposing apparatus may be in the bridge, over  
which is an arch.

30 In heating or air furnaces, or those having brick arches over the door, we  
sometimes place the decomposing and gas projecting apparatus in the brick-  
work, in which we form slots corresponding with the nipples or orifices for  
projecting the gases and channels for the introduction of air. We sometimes  
project the gases or air or both into the furnace from the side or sides of the  
35 furnace door. We also sometimes project steam by means of our above-  
described arrangement of nozzle perforations, burners, or cross jets, without  
decomposing the steam.

---



*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Robert Alfred Wright and Ernest Wright in the Great Seal Patent Office on the 23rd July 1864.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, ROBERT ALFRED WRIGHT, formerly of Pentonville Road, in the County of Middlesex, 5 and now of Homerton, in the same County, Engineer, and ERNEST WRIGHT, of Nelson Square, Blackfriars Road, in the County of Surrey, India-rubber Merchant, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-third day of January, in the year of our Lord 10 One thousand eight hundred and sixty-four, in the twenty-seventh year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Robert Alfred Wright and Ernest Wright, Her special licence that we, the said Robert Alfred Wright and Ernest Wright, our executors, administrators, and assigns, or such others as we, the said Robert Alfred Wright and 15 Ernest Wright, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN 20 APPARATUS FOR CONSUMING SMOKE AND PROMOTING THE COMBUSTION OF FUEL IN FURNACES," upon the condition (amongst others) that we, the said Robert Alfred Wright and Ernest Wright, our executors or administrators, by an instrument in writing under our or their hands and seals, or under the hand and seal of one of us or them, should particularly describe and 25 ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that we, the said Robert Alfred Wright and Ernest 30 Wright, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, reference being had to the accompanying Drawings, and to the letters and figures marked thereon, that is to say :—

The object of our Invention is to effect the consumption of smoke and promote the combustion of fuel in furnaces. For this purpose we employ gases produced by the decomposition of steam or water, which gases we



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

project into the furnace through nozzles, burners, nipples, or orifices, so arranged that the gaseous jets or streams projected therefrom shall impinge against and cross each other, and be thereby caused to spread and to veil the surface of the fire. We also project air into the furnace as well as or instead  
5 of the above gases. The nozzles, nipples, or burners may be disposed at an angle, or each nozzle or burner may have two or more perforations therein, so that the jets may cross each other.

To avoid repetition, we call the pipes, tubes, retorts, or vessels in which the steam or water is decomposed the decomposing apparatus. These pipes  
10 or vessels may be filled with fragments of iron, zinc, pottery, or other substances to facilitate the decomposition. The air may be admitted through passages surrounding or opposite the pipes, nozzles, nipples, or orifices through which the gases are led or projected into the furnace. The air holes may be opened or closed to the required extent by a perforated slide or plate, having  
15 also slots in it for receiving the pipes, nozzles, nipples, or burners, so that the slide may be worked to and fro. The feed pipe of the decomposing apparatus is furnished with a safety valve to prevent explosion. The plates at the back of our furnace may be cased or lined with refractory material. We construct an improved decomposing apparatus of one or more hollow discs or chambers  
20 having one plane and one convex surface. Also for decomposing the steam or water, and for projecting the gases, D-shaped pipes or pipes having one plane and one convex surface may be used, the flat surface being against the boiler plates.

We sometimes use decomposing or gas projecting pipes of a  $\Delta$ -shape, or  
25 having one convex and two plane surfaces or sides fitting into the angles of the furnace or fire-box. We sometimes form in the bridge passages or apertures, through which the gases produced in the decomposing apparatus or air under pressure are projected through a tube having nozzles, perforations, or burners, and placed in the body of the bridge. These passages or apertures,  
30 which may be lined wholly or partially with iron, communicate with the ash-pit and admit air therefrom; they have a regulating register or damper, the admission of gases to the nozzles or burners being regulated from the front of the furnace; the air thus becomes heated and propelled by the jets of steam, gas, or air with force and rapidity, and mingles with the gases of the fuel in  
35 combustion. We sometimes project the air through the bridge by steam admitted from the boiler without being passed through the decomposing apparatus; the heat of the bridge or of the lining of the passages assists to decompose the steam, the gases, steam, or air being highly heated in their passage through the bridge, are projected in an upward direction towards the



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

arch or lining, and in the direction of the draft, and mix with the gases of the fuel in combustion, the decomposition of which they promote.

We sometimes insert in the arch or lining a tube having nozzles or burners projecting downward and in the direction of the draft. We sometimes place in the furnace, over the fire a pipe of **D** or other shape, having a plane side 5 next to the boiler plate, and with nozzles or burners projecting downward towards the bridge in the direction of the draft.

The decomposing apparatus may be in the arch, or it may be a separate apparatus, whence the products are conveyed into the furnace. Vertical, horizontal, or inclined pipes may be used for decomposing. When we 10 introduce air under pressure we sometimes heat it by passing it through a coil or through the decomposing apparatus. We usually project the gases produced by decomposition together with air into the furnace, but we sometimes project heated air therein without the gases, and we employ for the projection of the air nozzles, nipples, burners, or orifices and pipes, arranged 15 as described for the projection of gases.

In Cornish boilers we sometimes, according to one arrangement, place the decomposing apparatus in the bridge, over which we fit a refractory arch. The gaseous products of decomposition are led from the decomposing apparatus to the front and outside of the furnace, and are conveyed into it again above 20 the door to be projected through nozzles or orifices as before described. Air may be admitted through or over the door or through the door frame or the dead plate, and forced into intimate combination with the products of combustion by inclining or directing the gas nipples, burners, or orifices downwards.

In locomotives, in one arrangement, we fit a bridge in the fire-box below 25 the tubes, and place the decomposing apparatus in this bridge, whence the gases are led under the fire-bars to outside the furnace, and are thence brought into it through the hollow stays in the water space below the furnace door, so that the gases may be projected into the furnace below the door. Over the bridge is an arch, whereby the gases are agitated, and the products of 30 combustion baffled.

For marine boilers the decomposing apparatus may be in the bridge, over which is an arch.

In heating or air furnaces, or those having brick arches over the door, we sometimes place the decomposing apparatus and our gas projecting apparatus 35 in the brickwork, in which we form slots corresponding with the nipples or orifices for projecting the gases, and we also form in the brickwork channels for the introduction of air. We sometimes project the gases or air, or both, into the furnace from the side or sides of the furnace door. We also some-



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

times project steam by means of our above-described arrangement of nozzles, perforations, nipples, burners, or cross jets without first decomposing the steam.

Having thus set forth the nature of our Invention, we proceed to describe the accompanying Drawings, which exemplify the mode of carrying it into effect.

DESCRIPTION OF THE DRAWINGS.

Figure 1 is a side view, Figure 2 a plan, Figure 3 transverse section on line *w, x*, and Figure 4 transverse section on line *y, z*, of Figure 2, shewing one form of nozzle, burner, or nipple A, having two orifices *a, a*, drilled therein, and inclined or at an angle to one another for projecting the decomposed gases in inclined streams crossing and impinging against each other, according to our Invention. Another form of such burner is shown at A<sup>1</sup>, Figure 5, which is a section representing burners or nozzles A, A<sup>1</sup>, screwed into pipes B<sup>1</sup>, branching from a pipe B, into which the gases are conveyed from the decomposing apparatus to be projected into the furnace. In Figure 6, horizontal section, and Figure 7, vertical section, the pipes B<sup>1</sup> are dispensed with, and burners A are let into the thickness of the pipe B; or instead of using nozzles A, the gases may be projected in the manner described through oblique perforations or passages *a* drilled through the thickness of the pipe B at an angle to or converging towards each other, as shown in the sections, Figure 8 and Figure 9.

In all the Figures herein-after referred to E is the pipe through which steam is brought from the steam boiler or steam chest to the decomposing apparatus D, in order to be more or less decomposed therein into gases. *e* is a stop-cock in pipe E; D is the decomposing apparatus; B is the pipe from which the gases brought from the decomposing apparatus are projected into the furnace through the nozzles, nipples, burners, or perforations. *a, a*, are the perforations in the said nozzles, nipples, burners, or pipe through which the gases are thus projected. *d*, pipe, leading into the pipe B from the decomposing apparatus D; S, steam chest; C, furnace; H, furnace door; I, fire-bars; J, bridge; G, safety valve in pipe E; A, A, are the nozzles or burners in pipe B.

Figure 10 sectional elevation, Figure 11 horizontal section, and Figure 12 front view, show our arrangement applied to a melting or such like furnace. The decomposing apparatus is at the side. F is a pipe with stop-cock *f* for drawing off water of condensation; K, shewn detached in side view, Figure 13, is a sliding plate formed with orifices *k* and slots *k*<sup>1</sup>, for regulating the



*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

admission of air, which enters freely when the holes  $k$  come opposite the nozzles A, but when the plate is slidden to shut off the air the nozzles come into the slots  $k^1$ .

Figure 14, sectional elevation, shews our arrangement applied to a locomotive fire-box. The steam may be brought directly from the steam chest S 5 into the pipe B, and more or less decomposed therein, without using a separate decomposing apparatus D, or a decomposing apparatus D formed with D-shaped pipes or with  $\Delta$ -shaped pipes might be inserted in the fire-box. The pipe B is over the door, so that the gases are projected thence from above the door in a downward direction to below the tubes or flues and above the 10 ordinary working level of fuel on the fire-bars, and the gases which rise from the incandescent fuel and such air as would enter when the door is open are forced into intimate combination with the projected gases, and pass with them into the tubes, flues, or interior of the fire-box. The pipe B is by preference of a D shape in transverse section, as shown on a larger scale in 15 Figure 15; we fix its flat side against the boiler plate, and we let the nipple A into the thickness of its convex side at the required angle, or we drill oblique orifices  $a, a$ , at a required angle therein.

In the modification, Figure 16, the pipe B is of a  $\Delta$  shape (or has one convex and two plane sides); the plane sides fit into the angle of the fire-box, 20 and the nozzles or perforations are in the convex side. We prefer to use these forms of pipe B, Figures 15, 16, for fire-boxes and other furnaces made of metal, and also for the pipes forming the decomposing apparatus in such furnaces. The flat or plane sides being in contact with the metal plates, do not attain a much greater heat than they do, and their rapid deterioration is 25 thus prevented.

We sometimes place the decomposing apparatus in the bridge, on the top of which we set an arch  $L^1$ , and we lead the decomposed gases outside the fire-box to the pipe B.

Figure 17 longitudinal section, Figure 18 horizontal section, Figure 19 30 transverse section, and Figure 20 external view, show our arrangements applied to a long furnace. Here we employ two or more pipes B for projecting the gases. These pipes B we designate, for convenience of description, No. 1, No. 2, No. 3, No. 4. No. 1 is in the bridge; No. 2 at the front of the furnace; No. 3 leads to one or more parts of the furnace over the fire-bars; 35 No. 4 is in a refractory arch L, which is thrown over the part  $J^1$  of the bridge. The decomposing apparatus is set in this part  $J^1$ , which we build of refractory bricks at the back of the bridge J, so as to form a continuation or portion thereof. Figure 21 is a horizontal section of the bridge. M, M, are a series



*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

of parallel inclined air passages formed in the bridge. The nozzles of the pipe B No. 1 open in these passages. The passages M, M, communicate at bottom with the ash-pit, and the admission of air through them therefrom is regulated by a door or damper  $k^2$ , worked by a handle  $k^3$  and catch plate  $k^4$ .

5 The steam which is conveyed from the steam-chest S through the pipe E to the apparatus D is more or less decomposed therein, and the gases so obtained are conducted therefrom through a pipe R to the front of the furnace, and thence by opening stop-cocks are led through the pipe  $r^1$  to the pipe B No. 1, or through the pipe  $r^2$  to the pipe B No. 2, or through other pipes to the

10 pipes B No. 3 and No. 4, so that gases may be projected into the furnace at various points. G is a safety valve;  $n$ , purge cock of B No. 1;  $b^1$ , purge cock of B No. 2.

Figure 22 is a horizontal section, and Figure 23 sectional elevation of a tyre heating or annealing furnace, in which the pipes B lie in air passages P, to which the admission of air is regulated as required.  $p, p$ , are slots in the brickwork leading from the passages P to the interior of the furnace, and corresponding with the nozzles A. The gases projected with rapidity at the openings  $a$  draw in the air through the slots  $p$ , and combine with it and propel it forcibly into the furnace.  $n$  is the purge of pipe B.

20 Figures 24 and 25 are transverse sections of decomposing pipes which we sometimes use. They are filled (for multiplying the heating surface) with fragments of iron or other substance, as in Figure 24, or with small pipes, as in Figure 25.

Figure 26 is an elevation, and Figure 27 transverse section of a decomposing apparatus, consisting of hollow discs or chambers D communicating by short pipes  $d$ . Each disc or chamber has one plane and one convex side.

When we project steam through the bridge without first decomposing it, we can sometimes use the arrangement shewn for projecting gases and air in Figures 17 and 21, of course dispensing with the decomposing apparatus. We

30 can project air under pressure in like manner by connecting the lower end of the pipe B No. 2 with an air pump, fan, or other machine for forcing air.

We project heated air under pressure thus:—We use an air pump, blowing machine, fan, or other contrivance for forcing air or putting air under pressure, which we connect with a coil placed in the bridge or other part of

35 the furnace, or with the decomposing apparatus, and we bring such coil or decomposing apparatus into communication with a pipe or pipes B, having nozzles, nipples, burners, or orifices A,  $a$ , for projecting the air. The air under pressure is thus heated before being projected towards the fire.

We sometimes modify the arrangement, Figure 14, by adding to the pipe B



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

nozzles or perforations so placed as to project the streams of gas in a line with the tubes or flues in order to increase the draft.

By means of the refractory arch L at the back of the furnace, Figure 17, which arch is thrown over the refractory brickwork J<sup>1</sup>, great heating surface is obtained, whereby the combustion of the gases arising from the fuel is 5 promoted, and the decomposing apparatus is more thoroughly heated.

When we project gases, steam, or air in the direction of the draft either by placing in the arch or lining a tube having nozzles, burners, or orifices directed downward, or by placing in the fire-box or furnace above the fire a pipe having a plane side next the boiler plate, and nozzles, burners, or orifices 10 directed downward towards the bridge or arch, we do not always use burners, nozzles, or orifices so disposed that the streams or jets which they project shall impinge against and cross each other, but any other convenient form of nozzle, burner, or orifice may be used.

When we admit water instead of steam into the decomposing apparatus we 15 prefer to introduce it therein in minute streams or drops.

Having now described the nature of our said Invention, and in what manner the same may be performed, we declare that we claim,—

First, the employment of nozzles, burners, nipples, orifices, or perforations so disposed as to project jets or streams of gas, air, or steam in an inclined or 20 other direction in such manner that such jets or streams shall impinge against and cross each other, and be thereby caused to spread and to veil the surface of the fire, substantially in the manner and for the purpose described.

Second, the employment of a decomposing apparatus, consisting of one or more hollow discs or chambers, having one plane and one convex surface, as 25 described.

Third, the employment of pipes of a **D** shape, or pipes having one plane and one convex surface, in the manner and for the purpose described.

Fourth, the employment of pipes of a **Δ** shape, or having one convex and two plane surfaces, in the manner and for the purpose described. 30

Fifth, the employment in the bridge of passages or apertures through which regulated supplies of air are introduced, which air becomes heated, and is propelled in a heated state by jets or streams of gas, steam, or air projected upward through the said passages or apertures by means of a tube in the bridge, substantially as described. 35

Sixth, the employment in the arch or lining of a tube having nozzles, burners, or orifices directed downward for projecting gases, steam, or air in the direction of the draft, as described.

Seventh, the employment in the fire-box or furnace above the fire of a pipe



---

*R. A. & E. Wright's Impts. in Apparatus for Consuming Smoke in Furnaces.*

---

having a plane side next the boiler plate, and with nozzles, burners, or orifices directed downward towards the bridge, so as to project steam, air, or gases in the direction of the draft, as described.

Eighth, the employment of a decomposing apparatus in the arch of furnaces or fire-boxes, as described.

In witness whereof, we, the said Robert Alfred Wright and Ernest Wright, have hereunto set our hands and seals, this Twenty-second day of July, in the year of our Lord One thousand eight hundred and sixty-four.

10

ROBT. A. WRIGHT. (L.S.)

ERNEST WRIGHT. (L.S.)

Witness,

S. E. A. NEWSOME.

---

---

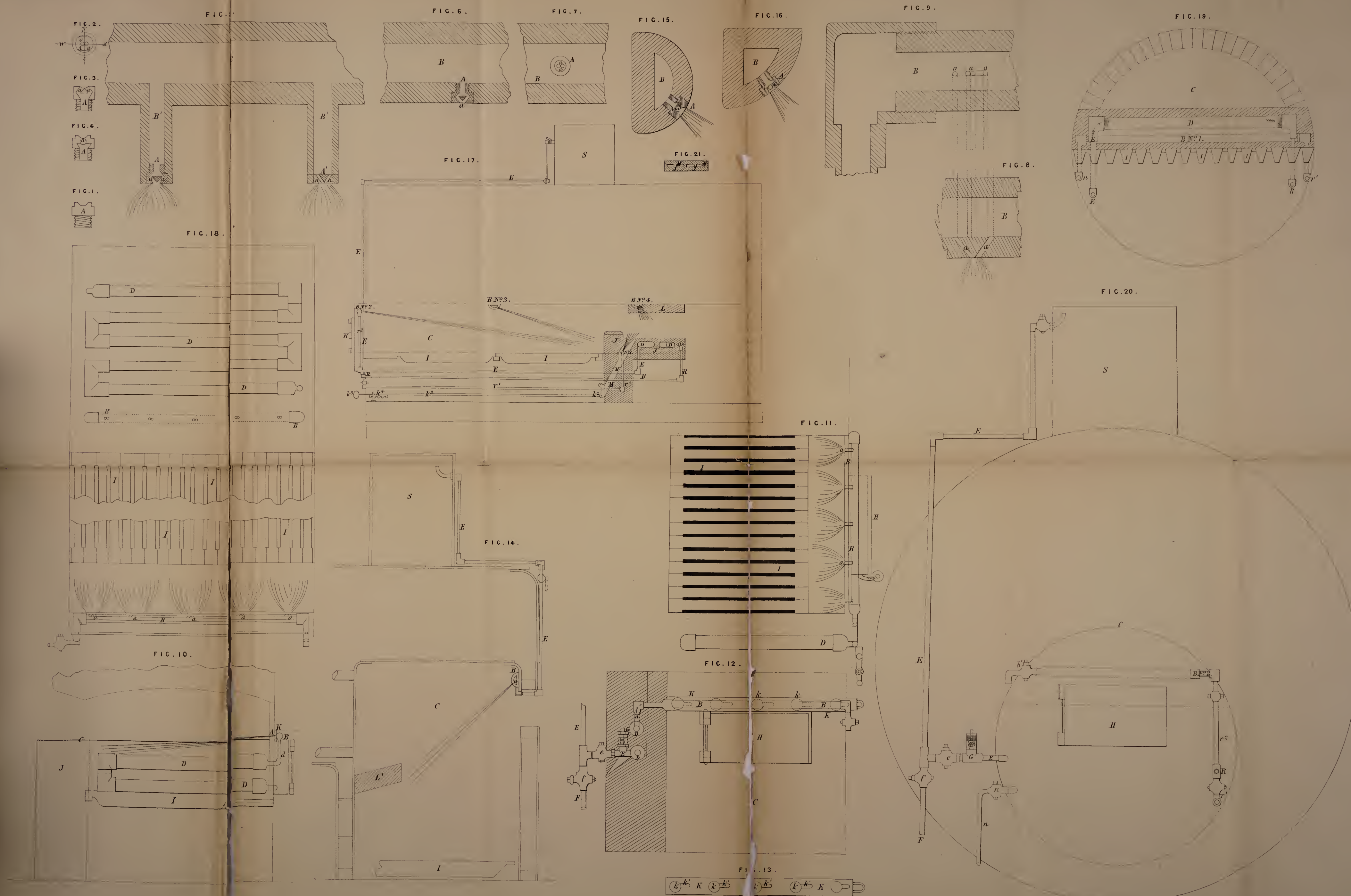
LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1864.















A.D. 1864. JAN. 23. N<sup>o</sup> 195.  
R.A. & E. WRIGHT'S SPECIFICATION.

FIG. 22.

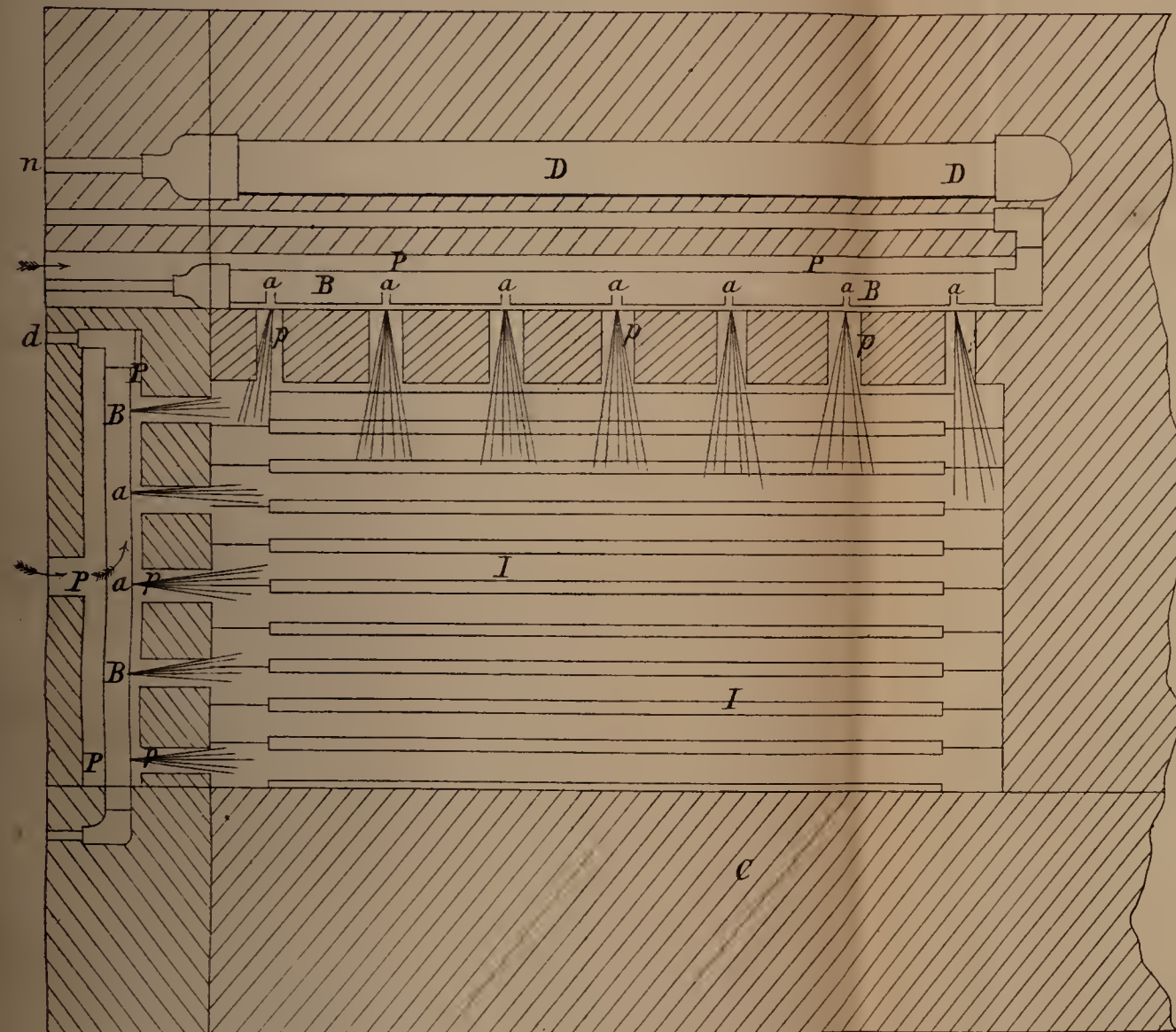


FIG. 23.

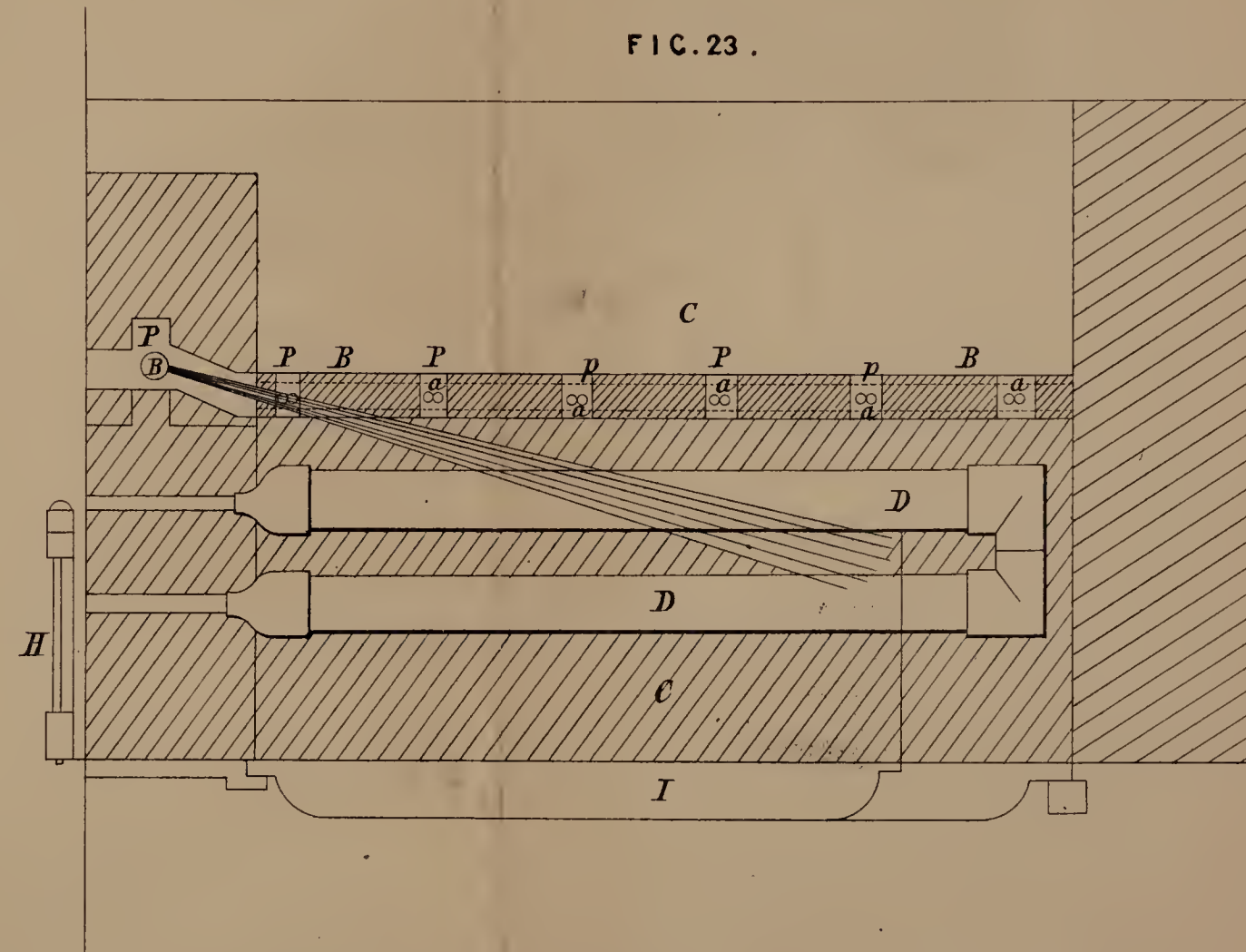


FIG. 26.

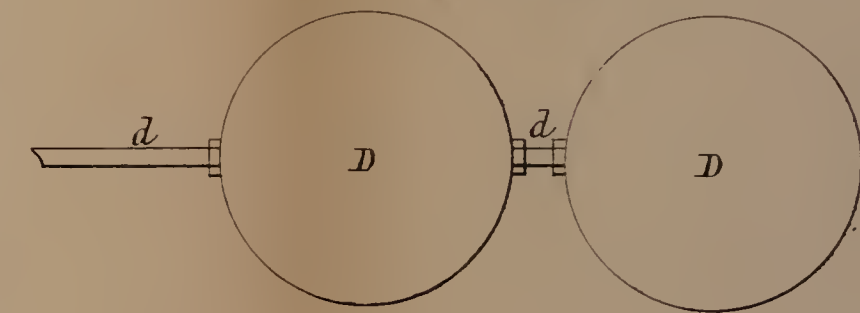


FIG. 27.



FIG. 25.

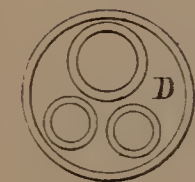


FIG. 24.



The filed drawing is not colored.

Drawn on Stone by Malby & Sons.



